

Extra-Articular Plasty for Revision Anterior Cruciate Ligament Reconstruction

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KEYWORDS

- ACL reconstruction • ACL revision • Anterolateral ligament • Extra-articular plasty • Lemaire

KEY POINTS

- Despite a well-performed anatomic anterior cruciate ligament (ACL) reconstruction, some patients continue to experience rotatory knee instability.
- In the setting of ACL rupture, the integrity of the anterolateral knee structures should always be evaluated.
- Although further studies are required, extra-articular lateral tenodesis at the time of ACL reconstruction may be beneficial in patients who have generalized ligamentous laxity, have a high-grade explosive pivot-shift test, participate in high-level sports, or are undergoing revision surgery and in chronic cases of damage to the anterolateral structures clearly evident clinically or radiographically.

INDICATIONS FOR EXTRA-ARTICULAR PLASTY

Recurrent or persistent laxity, in particular rotational laxity associated with a grossly positive pivot-shift test (PST), has been associated with the combined damage of the ACL and the anterolateral structures of the knee. Other investigators have also recorded probable evidence of damage of these structures along with ACL tears with the presence of a Segond fracture that results from avulsion of the iliotibial band (ITB) or the anterior oblique band of the lateral collateral ligament (LCL).¹⁻⁴ Further evidence of the gross instability after ACL and lateral structure damage is lateral tibial subluxation and the subsequent bone bruising observed on MRI.^{5,6} As Dodds and colleagues⁷ have recently reported, these anterolateral structures may not have been yet directly identified but probably act as secondary restraints of the PST, supplementing the primary role of the ACL in anteroposterior stability, with

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emphasis on rotatory stability. This rotatory laxity has been reported even after ACL reconstruction without failure of the ACL graft, suggesting that a single-bundle intra-articular reconstruction may not be sufficient to completely restore rotational knee stability in certain patients.⁸

The debate regarding combined injury to the ACL and anterolateral structures and the failure to provide rotatory stability in some patients has given rise to the strategy of combined intra-articular ACL reconstruction with extra-articular plasty.

The main arguments of the supporters of this procedure are as follows: (1) the evidence (discussed previously) of the additional structures being damaged in ACL tears favors the notion that additional structures need to be addressed at the time of ACL reconstruction; (2) the strong association of the anterolateral structures in controlling internal tibial rotation; and (3) the lateral extra-articular plasty is far from the center of the knee rotation and provides a greater lever arm for controlling PST and internal rotation than an intra-articular reconstruction.^{7,9-11} The rationale behind extra-articular plasty is, therefore, to create a restraint to internal tibial rotation.

Investigators who favor supplementary extra-articular plasty with standard ACL reconstruction have reported reduced PST results^{12,13} but the introduction of evidence-based inclusion criteria for any similar technique as a primary or a revision option is difficult and remains sporadic and empirically based.^{7,11,13} In the authors' practice, extra-articular plasty is performed in conjunction with primary intra-articular ACL reconstruction in the following circumstances:

1. Challenging primary cases of gross PST recorded or patients with increased body mass index participating in high-level sports activities
2. Chronic cases of ACL injury where damage to the anterolateral structures of the knee is clinically or radiographically documented
3. Revision cases of ACL reconstruction, especially cases of previous graft placement that was anatomic and where rerupture was the result of minimal force
4. Patients with joint hyperlaxity

SURGICAL TECHNIQUES

There have been several techniques of extra-articular tenodesis described in the literature since the 1970s. MacIntosh and Darby¹⁴ described a procedure where a 20-cm ITB strip was dissected, turned down to the Gerdy tubercle (GT), and then looped deep into the femoral condyle near the LCL. The Lemaire procedure involved the dissection of a 16-cm ITB strip, which was left attached to GT, passed under the LCL into a bone tunnel in the lateral femoral condyle, and then reattached to GT in a second bone tunnel.¹⁵ The Ellison procedure was a modification of the MacIntosh procedure, where the ITB strip was detached from GT before being inserted in the femoral condyle.¹⁶ Christel and Djian¹⁷ described a less invasive modification of the original Lemaire procedure, where a shorter ITB strip was twisted 180° and inserted to the lateral femoral condyle. Losee and colleagues² published a technique where the ITB was slinged and reefed around the posterolateral corner of the knee. In contrast to previous techniques, in the late 1990s, Marcacci and colleagues⁹ described a procedure of anterior cruciate ligament (ACL) reconstruction where a hamstrings graft was used both for intra-articular reconstruction and lateral tenodesis, through the over-the-top position. Several years later, Colombet¹⁸ used a single-bundle hamstrings graft passed through a tibial and femoral tunnel and fixed to the GT to perform the combined reconstruction. Describing yet another technique, Neyret¹⁹ proposed the combination of bone–patellar tendon–bone for intra-articular reconstruction and gracilis for extra-articular tenodesis.

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